CLAIMS

1. A method of processing a mixed-phase stream comprising:
introducing the mixed-phase stream into a heat exchanger; and
inducing the mixed-phase stream into spiral flow path.

2. The method as set forth in claim 1, further comprising a step of heating at least a portion of the mixed-phase stream.

3. The method as set forth in claim 1, wherein the step of inducing the spiral flow path comprises flowing the mixed-phase stream by a spiral-shaped element.

4. The method as set forth in claim 1, further comprising a step of vaporizing any volatile component from the mixed-phase stream to produce a substantially dry solid product.

5. The method as set forth in claim 4, wherein the substantially dry solid product is suitable for animal feed.

6. The method as set forth in claim 1, wherein the mixed-phase stream comprises stillage.

7. The method as set forth in claim 1, further comprising a step of hydroblasting a tube of the heat exchanger with a lance.

8. The method as set forth in claim 1, wherein the step of inducing the mixed-phase stream into a spiral flow path comprises introducing the mixed-phase stream into a tube of a heater having disposed therein a unitary spiral-shaped element.

9. A method of increasing solids concentration in a biomaterial stream having solid and liquid fractions comprising:
inducing non-turbulent spiral flow within a heat exchanger tube;

heating the biomaterial stream; and

vaporizing at least a portion of the liquid fraction from the biomaterial stream.

10. The method as set forth in claim 9, further comprising a step of drying the biomaterial stream to produce substantially dry solid product.

11. A system for processing a biomaterial stream comprising a biomaterial source in communication with a heater comprising a spiral-shaped element disposed in at least one heater tube.

12. The system as set forth in claim 11, wherein the spiral-shaped element has a width spanning less than about 50% of an inside diameter of the heater tube.

13. The system as set forth in claim 11, wherein the biomaterial source comprises a grain processing facility.

14. The system as set forth in claim 13, wherein the grain processing facility comprises at least one of grain handling, fermentation, distillation and dehydration unit operations.

15. A system for processing biomaterial comprising:

a grain handling unit operation;

a grain fermentation unit operation in communication with the grain handling unit operation;

a distillation unit operation in communication with the fermentation unit operation;

an evaporation unit operation in communication with the distillation unit operation; and

and a concentrator in communication with the evaporation unit operation, the concentrator comprising a heat exchanger comprising a spiral-shaped element disposed within a tube of the heat exchanger.

16. The system as set forth in claim 15, wherein the spiral-shaped element has width spanning less than an inside diameter of the tube.

17. The system as set forth in claim 15, wherein the biomaterial comprises corn.

18. A system for processing grain comprising:

a grain steeping unit operation;

a grinding unit operation downstream of the grain steeping unit operation;

a germ separation unit operation downstream of the grinding unit operation;

filtration and washing unit operations receiving material from the germ separation unit operation; and

a concentrator receiving heavy steep stream from the grain steeping unit operation, the concentrator comprising a heat exchanger comprising a spiral-shaped element disposed within a tube of the heat exchanger.

19. The system as set forth in claim 18, wherein the spiral-shaped element has width spanning less than an inside diameter of the tube.

20. The system as set forth in claim 19, wherein the spiral-shaped element is sized to permit internal cleaning of the heat exchanger tube with a hydroblasting lance.

21. A method of improving the heat transfer properties of a heat exchanger comprising installing an element into at least one heat exchanger tube that can induce a mixed-phase stream flowing therein into a spiral flow path.

22. The method as set forth in claim 21, wherein the element comprises a spiral-shaped element spanning at least a portion of the tube.

23. The method as set forth in claim 22, wherein the spiral-shaped element has an aspect ratio that is about 5.

24. The method as set forth in claim 21, wherein the step of installing the element comprises inserting a ribbon into the heat exchanger tube and winding the ribbon to twist the ribbon by at least one rotation into a spiral-shaped element.